California Energy Commission

Energy Commission Approach to Climate Research & Mitigation

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August 25, 2017

Critical Climate & Energy Milestones

- California's pursuit of a low-carbon future hits a critical milestone in 2030.
  - The Clean Energy and Pollution Reduction Act sets targets for energy efficiency and renewable generation for 2030.
  - SB 32 updated the Global Warming Solutions Act to require GHG reductions of 40 percent below 1990 levels by 2030.

- To reach these targets, the pace of technological progress in the energy sector will need to increase exponentially.

- California's leaders are developing and implementing policies to create the needed "market pull" for clean energy technologies.

GHG Reductions Require Significant Energy System Transformation

Progressive GHG and Renewable Portfolio Goals

- Intermittent Renewables vs Dispatchable Generation
- Increased Distributed vs. Central Station Generation
- Predictable vs Transactive Loads
- Incorporating Two-way Distribution Flow
- Maximizing Electric/Alt. Fuel vs Gasoline/Diesel
- Electrification of Industry, Commercial, Residential

Addressing Climate Risk, Resiliency, Safety, Costs, and Aging Infrastructure

Federal Funding at Risk in CA Clean Tech and Climate Research

Together, national labs, UC, Stanford, and Caltech typically receive more than $500 million per year for federally funded clean tech and climate research in California.

- More than $300 million/year for clean tech research.
- About $200 million/year for climate research.

Source: California Energy Commission staff. Rough estimate based on 2017 survey of California research institutions. Estimate includes multi-year awards divided by number of years.

Energy Commission Research Drives Low Carbon Technology Innovation

Electric Program Investment Charge - $125M/yr

- Energy Efficiency & Demand Response
- Renewable Energy & Adv. Gen.
  - Smart Communities
- Smart Grid, Storage, DER
- Environmental
  - Climate Adaptation and Infrastructure Risk Reduction
- Electric Vehicle Grid Integration
- Market Facilitation

Natural Gas R&D- $24M/yr

- Energy Efficiency
- Renewable Energy & Adv. Gen.
- Pipeline Safety
- Environmental
  - Methane Leakage
  - Climate Adaptation and Infrastructure Risk Reduction
- NG Transportation

Advancing the Science of Climate Change

Energy Commission climate science research provides critical understanding of California's changing climate, including:

- Lead California's 4th Climate Change Assessment for energy
- Develops climate projections and makes publically available
- Deep understanding of vulnerabilities
- Innovation to rapidly transform energy system
- Minimize impact to infrastructure and citizens, especially underserved communities
- Monitor and reduce methane emissions from the natural gas system
- Make results actionable by natural gas and electricity utilities

Current EPIC Portfolio: Creating a Smart DER Future

Zero Net Energy Communities

Higher Mix of Renewable Energy Integration

Energy Storage

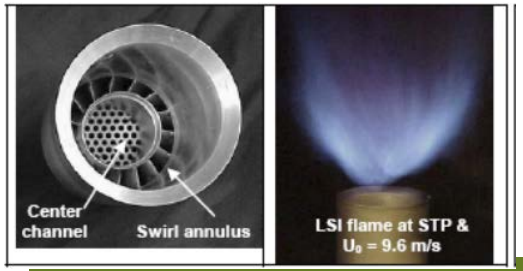
Renewable Forecasting & Modeling

Plug-In Electric Vehicles

Current Natural Gas Portfolio

Commercial Food Service

Commercial Laundry – CO2



Innovative Burner Designs

Advancing Biogas and Biomethane

Improving Pipeline and Storage Integrity

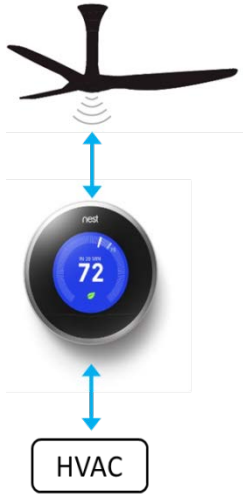
Climate Adaptation

Affordable & Efficient Low Income Housing

Near Zero Emissions Vehicles

Examples of Projects In Disadvantaged Communities/Low Income

Customer Centric Retrofits in Ontario



Smart Ceiling Fans with Communicating T-Stats

Customer Centric Retrofits in Fresno

ZNE Multifamily Evaluation- Cloverdale and Calistoga

Affordable ZNE Approaches with Habitat for Humanity

Emphasis on Equity

The Energy Commission adopted the Low-Income Barriers Study to explore barriers to and opportunities for expanding clean energy deployment in disadvantaged communities. The recommendations include:

- Conduct forums to share best practices and case studies on projects awarded in disadvantaged communities
- Analyze deployment models that would create market opportunities for clean technology in disadvantaged communities

Target:

25%

TD&D competitive funding to disadvantaged community project sites

EPIC Launched Energy Innovation Ecosystem:

--Tools for Entrepreneurs--

CENTRAL VALLEY

BLUETECH VALLEY

www.bluetechvalley.org

CALIFORNIA

CalSEED

www.calseed.fund

LOS ANGELES

LACI

www.laincubator.org

BAY AREA

ACTIVATION ENERGY

www.activationenergy.org

SAN DIEGO

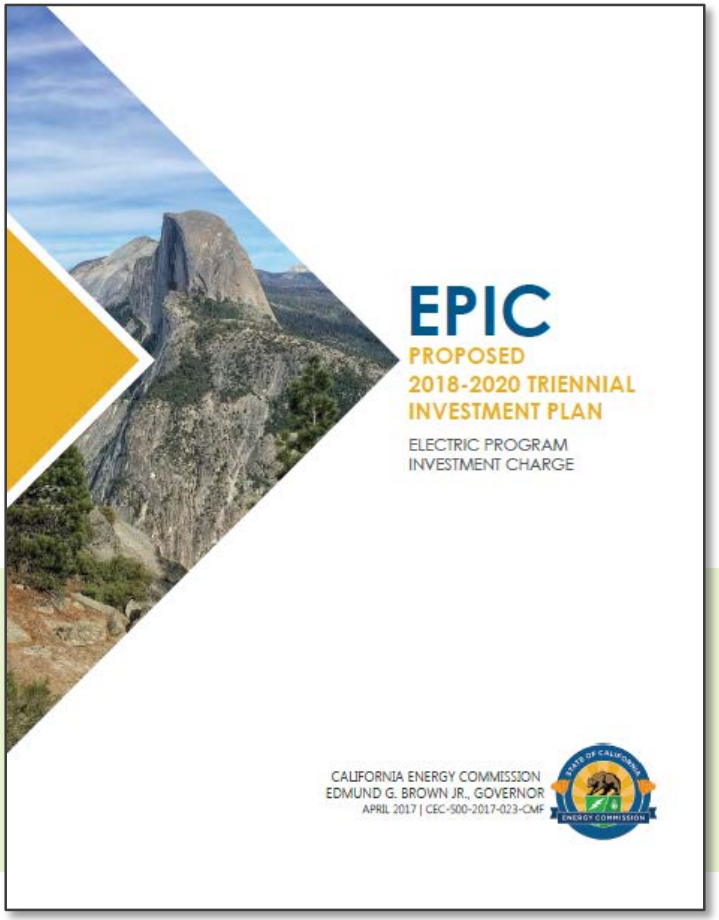
San Diego Regional ENERGY INNOVATION NETWORK

www.cleantechsandiego.org/sdrein

Going Forward

The Energy Commission submitted its EPIC 2018 – 2020 Proposed Investment Plan to the CPUC on May 1, 2017.

The research initiatives presented in this investment plan will enable California to continue to provide energy leadership and innovation necessary to carry out California's progressive energy policies and inform decisions and actions at local, state, federal and international levels; and further position California as the primary destination for top talent and investment in the clean energy economy.



EPIC 3 Strategic Objectives

1. Advance Technology Solutions for Continuous Energy Savings in Buildings and Facilities
2. Accelerate Widespread Customer Adoption of Distributed Energy Resources
3. Increase System Flexibility and Stability from Low-Carbon Resources
4. Increase the Cost-competitiveness of Renewable Generation

EPIC 3 Strategic Objectives cont'd

5. Create a Statewide Ecosystem for Incubating New Energy Innovations
6. Maximize Synergies in the Water-Energy-Food Nexus
7. Develop Tools and Analysis to Inform State Energy Policy and Planning
8. Catalyze Clean Energy Investment in Underrepresented and Disadvantaged Communities

Energy Commission Implementation of Research

- Transparent public process shaping research priorities
- Competitive process open to academics, private companies and non-profits
- Public –Private Partnerships encouraged to facilitate technology scale up and path to market
- Customer-sited demonstrations
- Research results publically available

Questions

Back Up Slides

EPIC Investment Plan Development

The CPUC requires the four EPIC Administrators, including the Energy Commission, to develop a three year investment plan.

The *EPIC 2018 – 2020 Investment Plan* was developed through an open process with multiple rounds of stakeholder engagement

- First scoping workshop was held on February 3, 2017
  - Staff presented draft strategic framework
- Second scoping workshop was held on March 14, 2017
  - Staff presented draft funding initiatives
- The Energy Commission received over 140 written comments in response to these workshops

EPIC Investment Plan Development

In addition to the scoping workshops, five topical workshops were held to inform the Investment Plan development.

- Distributed Energy Resources
  - March 13, 2017 in Sacramento
- Incorporating Community Focused Equity in Research Funding
  - March 20, 2017 in Fresno
  - March 27, 2017 in Los Angeles
- Climate Science Research & Customers of Climate Science
  - March 16, 2017 in Sacramento
  - April 11, 2017 in Sacramento

EPIC 3 Next Steps

- CEC submitted the *EPIC 2018 – 2020 Triennial Investment Plan* to CPUC on May 1, 2017
- CPUC considers the Investment Plans from all four EPIC Administrators from May through November 2017. Anticipated topics include:
  - Policy linkages and ratepayer benefits
  - Directing projects and results to DACs
  - Treatment of intellectual property
  - Review EPIC Independent Evaluation results
  - Workshops set for September 8th and 20th
- Anticipated approval in December 2017
- If approved, the Energy Commission will prepare and issue solicitations to fund the initiatives identified in this plan.

Awarded EPIC Projects

List of all active EPIC projects can be found in the Annual Report, Appendix C

Source: California Energy Commission 2016 EPIC Annual Report
http://www.energy.ca.gov/2017publications/CEC-500-2017-015/CEC-500-2017-015-CMF.pdf

CA Clean Tech and Climate Research: Typical Levels of Federal Funding

Federal funding for research	Both ($M/yr)	Clean tech ($M/yr)	Climate ($M/yr)	Subset of clean tech: ARPA-e ($M/yr)
National Labs	$ 234	$ 187	$ 47	$ -
UC	$ 244	$ 97	$ 147	$ 26
Stanford, Cal Tech	$ 46	$ 46	$ -	$ -
Other	$ 11	$ 11	$ -	$ 8
Total	$ 534	$ 340	$ 194	$ 34

Note: Rough estimate based on staff survey of federally funded "climate and clean tech" research. Estimate includes multi-year awards divided by number of years. Survey date: February 2017.

Source: California Energy Commission staff

Active EPIC R&D Solicitations

Funding Opportunity Title	Funding Amount
Advancing the Resilience and Environmental Performance of California's Electricity System (GFO-16-311) – due date October 9, 2017	$6.4 million
Increasing Adoption of Emerging Clean Energy Technologies through Procurement (GFO-17-301) – due date October 20, 2017	$30 million
Demonstrate Business Case for Advanced Microgrids in Support of California's Energy and GHG Policies (GFO-17-302) – due date October 20, 2017	$44.7 million
Federal Cost Share (PON-14-308) – Open • Applied Research • Technology Demonstration and Deployment	$7 million and $8 million, respectively

http://www.energy.ca.gov/contracts/epic.html

Anticipated EPIC R&D Solicitations (Estimated Release 8/2017 to 11/2017)

Funding Opportunity Title	Estimated Funding Amount
Sharing California's Energy Innovations: Communicating EPIC Research through Special Events, Forums and Multimedia Production	$6 million
Research Roadmap for System Transformation to Enable High Penetration of Distributed Energy Resources	$500,000
Research Roadmap for Cost and Technology Breakthroughs for Renewable Energy Generation	$350,000
Modeling Tools to Evaluate Distributed Energy Resources (DERs) and Microgrids Located Behind the Meter on California's Modern Distribution System	$9 million
Programmatic Approach to Existing Building Research, Development and Demonstration Program [potential for four programmatic awards for projects in Northern California, Southern California and Disadvantaged Communities]	$30 million

http://www.energy.ca.gov/contracts/epic.html

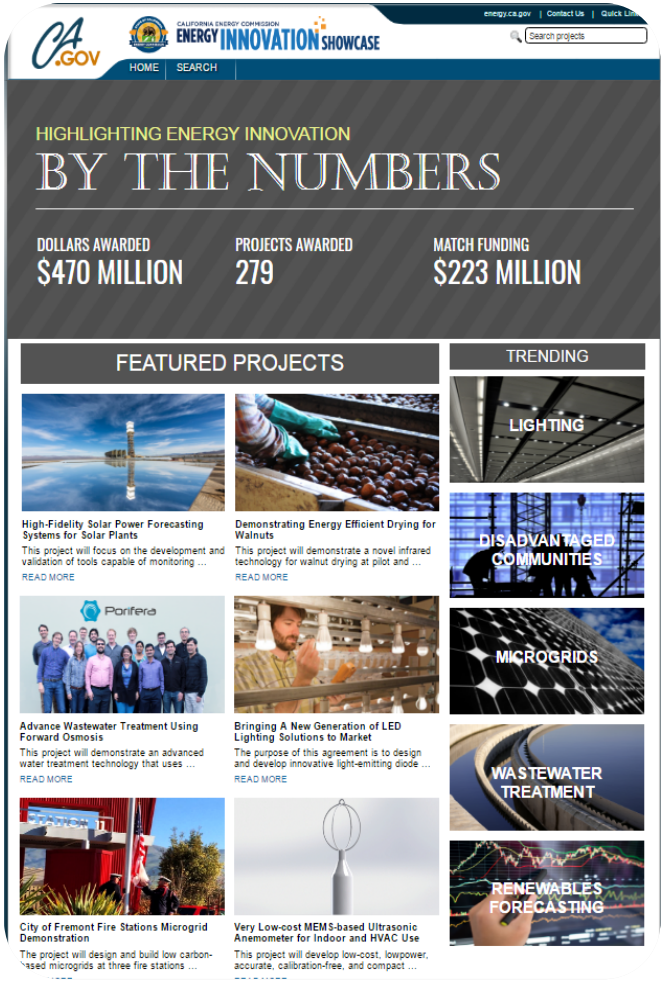
Active Natural Gas Solicitations

Funding Opportunity Title	Funding Amount
Improving Natural Gas Energy Efficiency, Waste Heat-to-Power, and Near-Zero Emission Distributed Generation Systems (GFO-17-501) – due date 10/10/17	$10.7 million

Anticipated Solicitations
Estimated Release 9/2017 to 12/2017

Funding Opportunity Title	Funding Amount
Addressing Barriers to Wider Adoption of Near-Zero Emission Natural Gas Vehicles	$3.4 million
Enhancing Safety, Environmental Performance, and Resilience of California's Natural Gas System	$8.9 million

http://energy.ca.gov/contracts/pier.html



Outreach & Engagement Opportunities

EPIC Innovation Showcase

- http://innovation.energy.ca.gov

Social Media

- Blogs, tweets and video features of research projects

Extensive public workshops on research scope, technology advancements, and market opportunities

Participating in meetings and events with diverse organizations